PATENT COOPERATI J TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE
in its capacity as elected Office

Date of mailing (day/month/year) 17 November 2000 (17.11.00)	
International application No. PCT/NL00/00174	**Applicant's or agent's file reference** P22179PC00
International filing date (day/month/year) 16 March 2000 (16.03.00)	**Priority date** (day/month/year) 17 March 1999 (17.03.99)
Applicant BUWALDA, Pieter, Lykle et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

17 October 2000 (17.10.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Zakaria EL KHODARY

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:
OTTEVANGERS, S., U.
Vereenigde Octrooibureaux
Nieuwe Parklaan 97
NL-2587 BN The Hague
PAYS-BAS

Date of mailing (day/month/year) 21 September 2000 (21.09.00)	
Applicant's or agent's file reference P22179PC00	**IMPORTANT NOTICE**

International application No.	**International filing date** (day/month/year)	**Priority date** (day/month/year)
PCT/NL00/00174	16 March 2000 (16.03.00)	17 March 1999 (17.03.99)

Applicant COÖPERATIEVE VERKOOP-EN PRODUCTIEVERENIGING VAN AARDAPPELMEEL EN DERIVATEN AVEBE B.A. et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
   AU,KP,KR,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
   AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CN,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,
   GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,
   NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW
   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
   21 September 2000 (21.09.00) under No. WO 00/54607

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, **a demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer
J. Zahra

Telephone No. (41-22) 338.83.38

Continuation of Form PCT/IB/308

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

Date of mailing (day/month/year)	IMPORTANT NOTICE
21 September 2000 (21.09.00)	
Applicant's or agent's file reference	**International application No.**
P22179PC00	PCT/NL00/00174

The applicant is hereby notified that, at the time of establishment of this Notice, the time limit under Rule 46.1 for making amendments under Article 19 has not yet expired and the International Bureau had received neither such amendments nor a declaration that the applicant does not wish to make amendments.

PATENT COOPERATION TREATY

WE

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Mr Ir A.W. Prins, C.S.
VEREENIGDE
Nieuwe Parklaan 97
NL-2587 BN The Hague
PAYS-BAS

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Beantwoord
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Applicant's or agent's file reference
P22179PC00

PCT

NRF2 17-9-2001

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing *(day/month/year)* 14.05.2001

IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00174	16/03/2000	17/03/1999

Applicant
COÖPERATIEVE VERKOOP-EN PRODUCTIEVERENIGING VAN...

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Götz, K Tel.+49 89 2399-7381

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P22179PC00		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00174	16/03/2000	17/03/1999
International Patent Classification (IPC) or national classification and IPC A23L1/0522		
Applicant COÖPERATIEVE VERKOOP-EN PRODUCTIEVERENIGING VAN...		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
17/10/2000	14.05.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Bendl, E Telephone No. +49 89 2399 8637

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL00/00174

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-31	as originally filed

Claims, No.:

1-12	as originally filed

Drawings, sheets:

1/8-8/8	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   - ☐ the description, pages:
   - ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-12
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-12
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations
   see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Chapter V ----------

Reference is made to the following documents:

D1 = WO-A-8912403
D2 = US-A-5 370 894
D3 = EP-A-0 796 868
D4 = US-A-4 386 212

Novelty

1) The claimed subject - matter does not meet the requirements for novelty (Article 33(2) PCT), because the method according to Claim 1, the use according to Claim 10 as well as the compositions according to Claims 5, 11 and 12 have already been disclosed in the prior art.

2) Document D1 reports on a method for providing a foodstuff with a smooth texture which involves the step of adding cross-linked starch particles to a foodstuff (see pages 3, 4 of D1). The starch is selected in such a way that it does not aggregate, but remains dispersed (page 5, lines 12-14). The particles may be sheared (see page 4, lines 17-31) or heated (see Example 1). Thus, D1 destroys novelty of the subject - matter of Claims 1, 5, 10, 11, 12.

3.) Smooth products are also obtained by the process according to document D2 (see col.1, lines 15-36 and col.3, lines 50/51). The starches are cross-linked and incorporated into various foods like salad dressings, milk, coffee, etc. Since the desired effect is only achieved if 98% of the particles have a size of less than 5 μm the requirements concerning the disaggregation as presently claimed must also be met. Again, novelty of the subject - matter of Claims 1, 5, 10, 11, 12 is destroyed.

4) Document D3 describes the preparation of products with short, smooth texture (sentence bridging pages 2/3). Thus, a starch must have been selected which has a capacity to disintegrate into discrete particles - otherwise the requirement would not be met. The product is stable to high shear and high temperature (page 4,

lines 18-23). Thus, again novelty of the subject - matter as claimed is destroyed by this disclosure.

5) In D4 products having a good texture and in particular a good sheen have been described. Cross-linked, derivatized starches are particularly preferred because of the improved texture, mouthfeel and sheen imparted to the foodstuff by such starch modifications (col.2, lines 29-34). Texture and sheen my be further improved by passing the starch through a screen (col.3, lines 12-15). Once more novelty of the claimed subject - matter is destroyed.

Inventive step

1.) In the case that novelty will be established, it will have to be examined whether the claimed subject - matter involves an inventive step (Article 33(3) PCT). Presently this dos not seem to be the case. In the documents cited above it is disclosed that starches / cross-linked starches have an influence on texture and sheen; particle size can even improve these effects (e.g. see D4). Thus, the claimed subject - matter is not considered to involve an inventive step.

2.) Dependent claims can only be regarded as formally meeting the requirements for novelty and inventive step if they refer to an independent claim which meets these requirements.

Chapter VIII ----------

Superfluous expressions like "without limiting the invention" (page 14) should have been deleted.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P22179PC00		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00174	16/03/2000	17/03/1999
International Patent Classification (IPC) or national classification and IPC A23L1/0522		
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Date of submission of the demand	Date of completion of this report
17/10/2000	14.05.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Bendl, E Telephone No. +49 89 2399 8637

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL00/00174

I. Basis of the report

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- ☐ furnished subsequently to this Authority in written form.
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   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-12
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-12
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations
   see separate sheet

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Chapter V ----------

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lines 18-23). Thus, again novelty of the subject - matter as claimed is destroyed by this disclosure.

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1.) In the case that novelty will be established, it will have to be examined whether the claimed subject - matter involves an inventive step (Article 33(3) PCT). Presently this dos not seem to be the case. In the documents cited above it is disclosed that starches / cross-linked starches have an influence on texture and sheen; particle size can even improve these effects (e.g. see D4). Thus, the claimed subject - matter is not considered to involve an inventive step.

2.) Dependent claims can only be regarded as formally meeting the requirements for novelty and inventive step if they refer to an independent claim which meets these requirements.

Chapter VIII ----------

Superfluous expressions like "without limiting the invention" (page 14) should have been deleted.

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
A23L 1/0522

A1

(11) International Publication Number: WO 00/54607

(43) International Publication Date: 21 September 2000 (21.09.00)

(21) International Application Number: PCT/NL00/00174

(22) International Filing Date: 16 March 2000 (16.03.00)

(30) Priority Data:
99200829.2 17 March 1999 (17.03.99) EP

(71) Applicant *(for all designated States except US)*: COÖPERATIEVE VERKOOP-EN PRODUCTIEVERENIGING VAN AARDAPPELMEEL EN DERIVATEN AVEBE B.A. [NL/NL]; Beneden Oosterdiep 27, NL-9641 JA Veendam (NL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: BUWALDA, Pieter, Lykle [NL/NL]; Mondriaanstraat 32, NL-9718 MJ Groningen (NL). BLEEKER, Ido, Pieter [NL/NL]; Poldermolen 22, NL-9791 LS Ten Boer (NL). WOLTJES, Jakob, Roelf [NL/NL]; Groningenlaan 42, NL-9642 EJ Veendam (NL). SEMEIJN, Cindy [NL/NL]; Fongersplaats 96, NL-9725 LD Groningen (NL).

(74) Agent: OTTEVANGERS, S., U.; Vereenigde Octrooibureaux, Nieuwe Parklaan 97, NL-2587 BN The Hague (NL).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: FOODSTUFF CONTAINING DISCRETE STARCH PARTICLES

(57) Abstract

The invention relates to starch used in the food industry, more specifically to starch used in processed foodstuff that, at least in one processing step, is subject to heat and, or shear treatment. The invention provides use of modified starches and methods to use these in foodstuffs (soups, (dairy) desserts, sauces, creams, dressings, fillings and such), that, when used in preparing foodstuff that is subject to heat and/or shear treatment, provide said foodstuff with the so desired smooth, short textures and shiny appearance, even after prolonged treatment where use of other starches would render the product slimy, coarse or dull.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
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DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
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8/pats

Title: FOODSTUFF CONTAINING DISCRETE STARCH PARTICLES

The invention relates to starch used in the food industry, more specifically to starch used in processed foodstuff that, at least in one processing step, is subject to heat and or shear treatment.

In nature starch is available in an abundance surpassed only by cellulose as a naturally occurring organic compound. It is found in all forms of green leafed plants, located in their roots, stems, seeds or fruits. Starch serves the plant as food for energy during dormancy and germination. It serves similar purposes for man and animal as well as lower forms of life. Man, however, has found uses for starch that extend far beyond its original design as a source of biological energy. Practically every industry in existence uses starch or its derivatives in one form or another.

In foods and pharmaceuticals starch is used to influence or control such characteristics as texture, aesthetics, moisture, consistency and shelf stability. It can be used to bind or to disintegrate; to expand or to densify; to clarify or to opacify; to attract moisture or to inhibit moisture; to produce short texture or long (stringy) texture, smooth texture or pulpy texture, to produce a (semi)solid gel or a (viscous) fluid, soft coatings or crisp coatings. It can be used to emulsify or to form oil resistant films. Starch can be used to aid processing, packaging, lubrication or moisture equilibration. Starch truly serves as a multifunctional ingredient in the food industry.

The most common sources of food starch are maize, potato, wheat tapioca, and rice. Maize is cultivated in warmer climates, with half of the world's production grown in the USA, its biggest crop. China, the second

largest producer in the world, grows about 10%. Approximately 70% of the world's potato supply is grown in the cool, moist, climate of Europe and Russia. Wheat, requiring a more temperate climate, is primarily grown in the USSR, North America, and Europe. Approximately 90% of world rice production comes from South and South East Asia, while tapioca is cultivated in the narrow tropical band at about the equator.

The building blocks of carbohydrates such as starch are α and β-D glucose which contain six carbon atoms and form pyranose rings. Through enzymatic condensation, one molecule of water is split out between two molecules of glucose to form a bond. This condensation occurs predominantly between carbons 1 and 4 but occasionally between 1 and 6.

Where the α 1,4 linkage develops, a linear chained homopolymer results which we refer to as amylose. The length of this chain will vary with plant source but in general the average length will run between 500 and 2,000 glucose units. Traditionally, amylose is considered as being only linear in configuration but recent investigations indicate the presence of limited branching in some amylose molecules.

The second type of polymer in starch develops when the enzymatic condensation between glucose units occurs at carbons 1 and 6. This occasional linkage, along with the predominant 1,4 bonding, results in a branching effect and the development of a molecule much more massive in size than amylose but with linear chain lengths of only 25-30 glucose units. This molecule is called amylopectin.

All starches are made up of one or both of these molecules but the ratio of one to the other will vary with the starch source. Maize has about 25-28% amylose with the remainder being amylopectin. High amylose maize can run as high as 80%. Waxy maize has none and tapioca

has about 17% amylose. Potato has about 17-25% amylose with the remainder being amylopectin.

As the plant produces the starch molecules, it deposits them in successive layers around a central hilum to form a tightly packed granule. Wherever possible, adjacent amylose molecules and outer branches of amylopectin associate through hydrogen bonding in a parallel-wise fashion to give radially orientated, crystalline bundles known as "micelles". These micelles hold the granule together to permit swelling in (heated) water without the complete disruption and solubilisation of the individual starch molecules.

These highly orientated and crystalline micellular areas explain the ability of ungelatinised starch granules to rotate the plane of polarised light to produce characteristic interference crosses. This bi-refringent cross is one of the features used in identifying starch source. When the radial orientation of the crystalline micelle is disturbed, the bi-refringent cross disappears.

Gelatinisation temperatures are considered as ranges covering the temperatures at which loss of bi-refringence is first noticed and less than 10% remains. This temperature range is greatly influenced by the binding forces within the granule which vary with species. High amylose maize has much greater bonding force than the other maize varieties due to the high degree of linearity within the granule. On the other hand, ortho phosphate ester groups within the potato granule tend to weaken bonding and lower energy requirements to gelatinise.

When the starch granule is heated in water, the weaker hydrogen bonds in the amorphous areas are ruptured and the granule swells with progressive hydration. The more tightly bound micelles remain intact, holding the granule together. Bi-refringence is lost. As the granule

continues to expand, more water is imbibed, clarity is improved, more space is occupied, movement is restricted and viscosity increased.

With the swelling of amylose-containing granules, some of the smaller amylose molecules are solubilised and leach out to re-associate into tight bundles which will precipitate if the starch concentration is low or will form a gel if the concentration is high. This is referred to as "set back" or retrogradation. The congealed paste will become cloudy and opaque with time and will eventually release water to shrink into a rubbery consistency.

Waxy maize has essentially no linear amylose molecules so its paste will remain flowable and clear. It will not gel or weep. Tapioca, having a small amount of amylose, gives a soft gel when pasted. Pastes from high amylose starch set to a very stiff gel.

To summarise the physical changes during gelatinisation: the granule swells and loses bi-refringence; clarity and viscosity increase; and smaller linear molecules dissolve and re-associate to form a gel.

In the unmodified form, starches have limited use in the food industry. Waxy maize starch is a good example. The unmodified granules hydrate with ease, swell rapidly, rupture, lose viscosity and produce weak bodied, very stringy and very cohesive pastes. In general, we modify starch to enhance or repress its inherent properties as appropriate for a specific application. To provide thickening, improve binding, increase stability, to improve mouthfeel and sheen, to gel, disperse or cloud.

In general, we cross-link to control texture and to provide heat, acid and shear tolerance. As a result, we have better control and improved flexibility in dealing with formulation, processing and product shelf-life. Cross-linking of starch in general is thought of as

a means to "spot weld" the granule at random locations, reinforcing hydrogen bonding and inhibiting granule swell and disruption.

This cross-linking treatment strengthens the relatively tender waxy starches so that their cooked pastes are more viscous and heavy bodied and are less likely to break-down with extended cooking times, increased acid or severe agitation. In general cross-link level of a starch (and in particular of a waxy starch, see for example EP 0 796 868) is selected so that the product contains many fully swollen, intact granules after processing and packaging to achieve optimal viscosity and textural stability.

Another important starch modification is that of stabilisation. This modification prevents gelling and weeping and maintains textural appearance.

In selecting the proper starch to do the job one must consider the processing temperature, the length of time at that temperature and the forces of shear that the pasted starch will encounter. Food starches are for example used by the dairy industry in a wide variety of products to provide many desired properties including viscosity, texture, mouthfeel and improved stability. Starch selection is particularly important when considering dairy products due to the sensitive nature of the proteins present in milk. Many factors have to be considered before a choice of starch can be made; processing conditions, ingredients and storage requirements all influence the overall performance of a starch.

The higher the temperature, the greater the shear and the longer the time exposed to these forces, the more swollen the granule and the more fragile and susceptible it is to rupture. We can build in tolerances to shear, temperature and acid by supplementing hydrogen bonds in the granule by cross-linking.

In general it is desired to reach gelatinisation temperature during processing to ensure that the texture benefits of the starch are fully realised. Two exceptions to this are use of pregelatinised starch and use of starches in cook-up mixes, where the consumer will adequately cook the mix at home. Cooking time, temperature and amount of shear are all important parameters to consider when selecting a starch. Higher temperatures, higher shear rates and longer holding times all increase the degree of cook on a starch. For example, a modified starch can be cooked at 90°C for 10 minutes (to reach optimal viscosity) but needs only 5-15 seconds at Ultra-High-Temperature (UHT) processing at 140°C.

Resistance to shear is considered particularly important in dairy and other products which are subjected to homogenisation. If the product contains a 'cook-up' type starch and is homogenised before cooking, then the starch passes through relatively undamaged. However, if the starch is gelatinised, it must be highly resistant to withstand the high shear encountered to avoid excessive granule rupturing resulting in starch comprising amorphous amylose and/or amylopectine conglomerations rendering the food with a slimy texture.

When foods are heat treated to pasteurisation temperature (75°C), unless the proper starch is selected, the starch paste in the food system may be under-cooked, resulting in a cloudy, thin product. If foods are held at elevated temperatures for extended times, as may be the case in a kettle cook prior to filling, the starch may be over-cooked. This again may result in a product with ruptered starch granules with an undesirably amorphous, long and cohesive texture which makes the mouthfeel of the product slimy, which is in general not wanted by a customer who often prefers a short texture instead.

The impact of processing equipment on the starch granule is thus in general considered crucial. Shearing

forces exerted by high speed mixing, milling, homogenisation or pumping can damage the starch granule and make the resulting foodstuff slimy. As mentioned earlier, by cross-linking the starch one in general builds in tolerance to shear as well as to temperature and acid. This is for example a requirement for salad dressing starches which are cooked at low pH, at high temperatures and are also subjected to colloid milling. Pudding starches subjected to flash cooling would be another example of a need for shear tolerance.

However, use of cross-linked starches in foodstuff subject to medium or high shear or temperature treatment has disadvantages as well, as it is in general not possible to provide a starch comprising foodstuff, such as a dessert, a sauce or soup, with a short, smooth or creamy texture and a shiny appearance. In general, use of cross-linked starches in foodstuff subject to shear and heat results in foodstuff having a blind or coarse texture or dull appearance. Empirically, however, it has been found that use of some types of cross-linked waxy cereal starches can result in foodstuff that, albeit somewhat thin because of lack of viscosity depending on the cross-link level used, is at least provided with a reasonably fair shortness, smoothness or shininess. However, often other, more expensive thickeners, such as gums or gelatine, need be used to improve the textural and visual properties of the product and provide resistance to processing conditions such as shear or temperature treatment.

The invention provides use of modified starches and methods to use these in foodstuffs (soups, (dairy) desserts, sauces, creams, dressings, fillings and such), that, when used in preparing foodstuff that is subject to heat and/or shear treatment, provide said foodstuff with the so desired smooth, short textures and shiny

appearance, even after prolonged treatment where use of other starches would render the product slimy, coarse or dull.

The invention provides a method for preparing a foodstuff having a short or smooth texture and/or shiny appearance after medium to high heat and/or medium to high shear treatment comprising adding to the ingredients of said foodstuff a cross-linked starch or starch granule selected for its capacity to disintegrate into discrete particles after processing, in particular after heat and/or shear treatment. The invention described herein provides the insight that the textural sensations shortness and smoothness, and the visual sensation shininess, of food comprising starch, are among others related to size and cohesiveness of the starch fragments present in said food. Herein it is found that the presence of discrete starch particles smaller than general swollen starch granule size is beneficial to obtaining a food with those desired characteristics.

In short and oversimplified the insight provided by the invention is that use of a starch that, at least in the end product, after processing, has a large swollen starch granule leaves the food dull and blind, use of a starch having a ruptured granule after processing leaves the food with the slimy amorphous amylose or amylopectin conglomerates, but use of a starch which granules, after processing, disintegrate into cohesive or discrete starch particles smaller than general swollen starch granule size leaves the food short, smooth and/or shiny.

To generate a fat-like mouthfeel, WO89/12403 uses a cross-linked quinoa starch which particles are already very fine (diameter 1 to 5 microns), explicitly avoiding having to use more commonly available starches with much larger granules which are deemed not suitable. The present invention, however, preferably provides use of the more commercially attractive large granule type

starches that are disintegrated from a dispersion into discrete fragments during or before preparing the food product, and does also not resort to making anew fragments from carbohydrate solutions, to provide the desired organoleptic characteristics. Similarly, very fine granule type starches (0. to 4 micron), such as selected from Colacasia esculenta, Saponaria vaccaria, Amaranthus retroflexus, Maranta arundinacea, Wheat B and buckwheat and again not commonly available are used in US 5370894, whereas the present invention uses starches with much larger particles to begin with, having average diameters of more than 10, preferably more than 15, and even more preferably more than 20 micron, that are capable to disintegrate from a dispersion into discrete fragments, said fragments providing the desired organoleptic characteristics.

WO98/31240, preferably starting from rice starch which has granule diameters of in general between 2 and 10 micron, mixes raw (non-cross-linked) starches with protein solutions to obtain a texturing agent having distinct size patterns, being mixtures of smaller (e.g. 0.1 to 20 microns) and larger (e.g. 100 to 400) particles.

In a preferred embodiment, the invention provides a method for preparing a foodstuff having a short or smooth texture and/or shiny appearance after medium to high heat and/or medium to high shear treatment comprising adding to said foodstuff a starch comprising cross-linked starch granules capable of disintegrating into discrete particles after heat and/or shear treatment further comprising subjecting said foodstuff to heat and/or shear treatment. As for example can be seen when comparing tables 3 and 4, heat and shear treatment even brings out the desired characteristics when using starch according to the invention.

The invention furthermore provides a method according to the invention wherein said cross-linked starch granules are non-cereal starch granules. For foodstuff, it is in general desirable that a starch be bland or neutral in flavour when used in desserts, sauces, soup-mixes, pie fillings, dressings and the like. The starches generally having the most neutral taste are non-cereal, such as tuber- or root-type, starches, such as potato or tapioca, when compared to starches such as corn, wheat, rice, sorghum, waxy maize and waxy sorghum, which, when incorporated into food, give some undesirable flavour (peculiar to the starch) to the food. These off-flavours have been described by some individuals as 'woody', 'corny', 'starchey', 'bitey' or 'chalkey', and these flavours often come out most poignant after heat treatment. It is now very well possible to avoid these off-flavours in foodstuff subject to heat and/or shear treatment by using a non-cereal starch according to the invention in the preparation of these foods.

In a preferred embodiment of a method according to the invention said starch is potato starch, preferably a degraded potato starch, preferably derived from a normal potato, preferably having normal amylose content. Degradation can be achieved by treatment with oxidising agents, or enzymes, or preferably, by treatment with acid, such as by treatment with a mineral acid, such as sulphuric acid or by treatment with sodium hypochlorite. Degrees of degradation are preferably chosen so that a certain measure of disintegration, of course depending on the preferences of the public for which the foodstuff is mainly intended, can be reached after processing, to arrive at the so desired discrete particles providing the desired texture or organoleptic properties, to retain or obtain an essentially short, smooth texture, preferably with shine.

Acid treatment is for example already practised to improve taste (US 4,368,212), but therein not to improve organoleptic characteristics such as texture, mouthfeel and shine.

Also preferred is a method according to the invention wherein said starch granules are derived from a starch of the so-called waxy type, herein defined as having a amylopectin:amylose ratio of at least 90:10, preferably at least 95:5, more preferably at least 99:1. With higher amylopectin content of the granule it is easier to obtain discrete starch particles, especially using low cross-link levels, without degradation. Even more preferred is a starch derived from a waxy-type potato, wherein it is possible to vary most with cross-link ratios, especially when compared with waxy corn. Degrees of cross-linking are preferably chosen so that a certain measure of disintegration can be reached after processing, to arrive at the so desired discrete particles providing the desired texture or organoleptic properties, to retain or obtain a short, smooth texture, preferably with shine.

The invention also provides a cross-linked starch granule capable of disintegrating into discrete particles after medium to high heat and/or medium to high shear treatment. Said discrete particles are demonstrated in several of the microscopic images given herein, and foodstuff containing such discrete particles can easily be distinguished from other foodstuff by measuring particle size distribution, as exemplified in figure 19. In a preferred embodiment, the invention provides a non-cereal starch granule capable of disintegrating into discrete particles after medium to high heat and/or medium to high shear treatment, preferably derived from an acid degraded potato starch or from a potato starch having a amylopectin:amylose ratio of at least 90:10, preferably at least 95:5, more preferably at least 99:1,

for example derived from a genetically modified potato plant mutant or from an amylose-free potato plant mutant.

In a preferred embodiment, the invention provides a starch granule according to the invention, said granule having been subjected to cross-linking. Cross-linking starch in itself is a method known in the art and various agents are known. Examples are: epichlorohydrin, sodium trimetaphosphate, phosphorous oxychloride (POCl3), adipic anhydride, or other reagents with two or more halogen, halohydrin or epoxide groups or combinations which all can be used as cross-linking agents. Preferred are distarch phosphates and distarch adipates. A cross-linked or cross-bonded starch may for example be cross-bonded with 0.003 to 0.024% of adipic anhydride, preferably with 0.01 to 0.03%. Prior to cross-bonding with adipic anhydride the starch may be treated with hydrogen peroxide and/or peracetic acid. Preferably with a quantity which corresponds with 0.001% to 0.045% of active oxygen, most preferably with 0.005 to 0.045%. A distarch phosphate may for example be cross-bonded with sodium trimetaphosphate up to such a degree that the residual phosphate is no more than 0.14% for a potato starch or 0.04% for other starches. Preferably the starch is cross-bonded with 0.01% to 0.25%, most preferably with 0.025 to 0.15% of sodium trimetaphosphate, under conditions known to the artisan. Degrees of cross-linking are preferably chosen so that a certain measure of disintegration can be reached after processing. For example, for sodium trimetaphosphate (STMP) cross-linking, 0-5000, preferably 250-2500 mg STMP/kg starch is used, for $POCl_3$, 0-400, or 0-200, preferably 40-150 or 75-100 μL POCl3/ kg starch is used. Of course it is always possible for the artisan to find conditions, possibly in which the reactants react with a low yield, outside of the preferred conditions resulting in a starch with desired properties. A distarch phosphate may as well be cross-bonded with phosphorous oxychloride up to such a degree that the residual phosphate is not more than 0.14%

for a potato starch or 0.4% for other starches. Preferably the starch is cross-bonded with 0.00010 % to 0.01% of phosphorous oxychloride, under conditions known to the artisan. Of course it is always possible for the artisan to find conditions in which the reactants react with a very low yield, outside of the preferred conditions resulting in a starch with the desired properties.

Also preferred is a starch granule according to the invention having been subjected to stabilisation. Stabilisation in general is done by a method known in the art, such as by treatment with acetic anhydride or vinyl acetate, by hydroxyalkylation or comparable treatment. Stabilisation by hydroxyalkylation of starch is for example obtained with reagents containing a halohydrin, or an epoxide group as reactive site. The addition of hydroxypropyl groups is generally performed in aqueous suspensions of starch using propylene oxide, under alkaline conditions. Cross-bonding and/or stabilising reagents are reacted with starch under alkaline conditions. Suitable alkali materials are: sodium hydroxide, potassium hydroxide, ammonium hydroxide, magnesium hydroxide, sodium carbonate and trisodium phosphate. Preferred are the alkali metal hydroxides and carbonates, most preferred are sodium hydroxide and sodium carbonate. Sometimes salts are added as to prevent swelling under alkaline reaction conditions. Preferred are sodium chloride and sodium sulphate. Stabilisation by acetylation is performed using acetic anhydride or vinyl acetate. Other stabilisation reagents are for example succinic anhydride, 1-octenyl succinic anhydride, sodium tripolyphosphate, potassium orthophosphate, sodium orthophosphate or orthophosphoric acid.

The invention also provides foodstuff having been subjected to heat and/or shear treatment comprising discrete particles derived from a granule according to the invention. Such foodstuff is provided having an improved texture and/or appearance, especially being

short, smooth or shiny. The invention also provides use of a starch granule and/or method according to the invention in the preparation of foodstuff subject to heat and or shear treatment to improve texture and/or taste of said foodstuff. The invention is further explained in the detailed description herein without limiting the invention.

Detailed description

Preparation of hydroxypropylated crosslinked starches

A 39% starch slurry was prepared from different raw materials. To this slurry was added sodium sulfate (100 g/kg starch) and sodium hydroxide (7.5 g/kg starch) as a 4.4 % solution. The temperature was raised to 35 °C and sodium trimetaphosphate (NaTMF) was added. For low crosslinked starches 625 mg NaTMF/kg starch was used, low being defined as varying between 325 to 1000 mg NaTMF/kg starch or functionally equivalent with other cross-linking agents, the high crosslinked starches were prepared with 2500 mg NaTMF/kg starch, high being defined as varying between 1000 to 3500 mg NaTMF/kg starch or functionally equivalent with other cross-linking agents. Next, propylene oxide (DSmax = 0.33) was introduced and the reaction was allowed to proceed for 20-24 hours. The slurry was neutralized with sulfuric acid to a pH of 5-6 and washed and dried by using conventional means known to the art. The raw materials used were amylopectin potato starch, normal potato starch and waxy maize starch and degraded potato starch. For the degradation of potato starch, different methods were used such as acid degradation, oxidative degradation or enzymatic degradation, employing conditions well known in the art. For example, a 39% starch slurry was treated with 10 N H_2SO_4 (in a quantity corresponding to 0.5-20 mol%, or wih

sodium hypochlorite with a quantity corresponding to 0.1-5% Cl_2 for 6-24 hours at 35-55, preferably 45°C. After washing and drying the product was used as a raw material for the hydroxypropylation and cross-linking. Preferably higher cross-link levels then 625 mg NaTMF were used due to the lower molecular weight of the degraded starches.

Viscosity and disintegration measurements

A slurry containing 5% hydroxypropylated and crosslinked starch on a dry weight basis was prepared and heated in a Brabender viscograph following a temperature profile. First the suspension was heated to 45 °C rapidly, then the mixture was heated to 90 °C at a rate of 1.5 °C/mine and kept at this temperature for 20 min. Finally the solution was cooled to 25 °C at a rate of 1.5 °C/min. From the solution thus obtained the viscosity was measured on a Brookfield apparatus and a microscopic picture was taken of the solution which was diluted in some cases. Next the solution was exposed to high shear conditions (Ultraturrax, 10000 rpm) for one and two minutes and the same measurements were performed. Apart from these measurements the texture of the solutions was investigated.

Table 1 shows the results of the viscosity measurements and Table 2 the results of the microscopic pictures of the solutions (see figures 1 to 16 for the photographs).

Table 1 - Viscosity measurements

starch	crosslink level	Brookfield (mPas)		
		for shear	after 1 min. shear	after 2 min. shear
amylopectin	low	37350	28200	23750
amylopectin	high	104	1980	1330
normal PS	low	1330	12066	10440
normal PS*	high	-	-	-
waxy maize	low	2000	3490	3110
waxy maize	high	18	-	64
acid degr. PS**	low	11760	-	980
acid degr. PS**	high***	14000	-	6050

*the high crosslinked normal potato starch was to thin for a good measurement.

**6% concentration

***high is 1250 mg NaTMF/kilo starch (20% moisture)

Table 2 - Microscopic pictures

starch	crosslink level	disintegration level of particles		
		before shear	after 1 min. shear	after 2 min. shear
amylopectin PS	low	big, swollen	mostly dis-integrated, small	completely disintegrated, very small
amylopectin PS	high	medium size, swollen	partly dis-integrated	mostly dis-integrated, small
normal PS	low	small, swollen	big, swollen	very big, swollen
normal PS	high	small, swollen	-	medium size, swollen
waxy maize	low	medium size, swollen	mostly dis-integrated, small	completely disintegrated, very small
waxy maize	high	small, swollen	-	small, swollen
acid degr, PS	low	large swollen	-	very small disintegrated
acid degr. PS	high	large swollen	-	small, disintegrated

Disintegration only takes place with the waxy and with the degraded derivatives. Both high and low crosslinked amylopectin potato starch show disintegration whereas only the lower crosslinked waxy maize derivative disintegrated under the applied shear. The amylopectin and the degraded potato starch derivative with the lowest crosslink level after shear consisted of smaller particles then the derivatives with the higher crosslink level.

All potato starch derivatives before shear essentially have a pulpy, coarse or dull texture. After shear the amylopectin and the degraded derivatives have changed to a smooth, shiny and short paste. The lower crosslinked amylopectin potato derivative is more cohesive than the higher crosslinked derivative which is similar to the waxy maize derivative after shear. The degraded potato starch derivative gave a low viscous shiny dispersion while the higher crosslinked derivative gave a viscous paste comparable to the higher crosslinked amylopectin potato starch derivative. The normal potato starch products stay pulpy and dull after shear. The waxy maize derivatives become more shiny, smooth and creamy after shear but the difference between the paste before and after shear is not so explicit as for the amylopectin potato starch derivatives. Of all the derivatives only the lowest crosslinked amylopectin potato starch gave a clear paste which makes it very suitable for application in a fruitfilling. The results are summarised in the following two tables.

Table 3 - Texture of the 5% solutions before shear

starch	crosslink level	appearance
amylopectin	low	viscous, pulpy, dull
amylopectin	high	thin, coarse, dull
normal PS	low	medium viscous, pulpy, dull
normal PS	high	very thin, coarse, dull
waxy maize	low	medium viscous, reasonable shiny, blind
waxy maize	high	very thin, reasonable shiny, blind
acid degr. PS*	low	viscous, pulpy, dull
acid degr. PS*	high	viscous, pulpy, dull

*6% solutions

Table 4 - Texture of the 5% solutions after 2 min. shear

starch	crosslink level	appearance
amylopectin	low	highly viscous, short, shiny, smooth, cohesive, clear
amylopectin	high	viscous, shiny, smooth
normal PS	low	viscous, pulpy, dull
normal PS	high	thin, coarse
waxy maize	low	medium viscous, shiny, smooth, short, creamy, cohesive, blind
waxy maize	high	thin, shiny, blind
acid degr. PS*	low	thin, shiny, clear
acid degr. PS*	high	viscous, shiny, smooth, reasonably clear

*6% solutions

When hydroxypropylated crosslinked amylopectin or degraded potato starch is used in an application were high shear is involved in the procedure a smooth and

shiny product is obtained. Amylopectin potato starch products with a low crosslink level are very clear and have a cohesive structure. This cohesiveness is also found in similar waxy maize derivatives but the latter lack the clearness. Amylopectin potato starch products with a higher crosslink level are not clear and less cohesive but still smooth and shiny. Degraded potato starch derivatives with a high crosslink level behave similar while the lower crosslink level gives a low viscous dispersion consisting of small particles. Normal potato starch derivatives give under the high shear conditions pastes with pulpy and dull textures. On a granule level it was observed that the big swollen particles of amylopectin and degraded potato starch paste disintegrate under influence of high shear which is not observed with a similar normal potato starch derivative. This phenomenon accounts for the texture differences. Maize derivatives also disintegrate but this was only observed on a low crosslink level.

A hydroxypropylated and crosslinked derivative of amylopectin or degraded potato starch derivatives give smooth, short and shiny textures when they are cooked and a certain amount of shear is applied (jetcooking). A similar derivative of normal potato starch does not have these features. When this derivative is jetcooked the solution gave a dull and pulpy texture. In some applications such as dressings, fruitfillings and puddings the smooth and shiny texture is desired while in other applications such as tomato sauce the pulpy texture is preferred. The observed difference is caused by the ease of granular disintegration of the amylopectin and degraded derivative compared to the normal potato starch derivative. To visualize this effect some hydroxypropylated amylopectin potato starch, acid degraded potato starch, normal potato starch and waxy maize derivatives with two degrees of crosslinking were prepared and investigated after heating under low-shear conditions and after high-shear conditions. Microscopic

pictures were taken from the solutions to visualize the difference in particle size.

Food examples.

Spoonable dressings

Equipment Fryma colloidal mill

Dressing A (pH 4,3-4,4)

Ingredients

	%	g
Starch derivative	6,0	180
Paselli MD10	5,0	150
Powdered sugar	2,0	60
Salt	1,5	45
Sodium benzoate	0,1	3
Potassium sorbate	0,1	3
Vinegar (5%)	8,0	240
lemon juice	0,8	24
Mustard	1,0	30
Egg powder (whole)	2,4	72
Oil	2,0	60
Tap water	71,1	2133
Total	100,0	3000

Dressing B (pH 3,6-3,70)

	%	g
Starch derivative	6,0	180
Paselli MD10	5,0	150
Powdered sugar	5,0	150
Salt	1,5	45
Sodium benzoate	0,1	3
Potassium sorbate	0,1	3
Vinegar (5%)	10,0	300
Citric ad	0,4	12
Mustard	1,0	30
Egg powder (whole)	2,4	72
Oil	2,0	60
Tap water	66,5	1955
Total	100,0	3000

Preparation procedure

- Mix in a plastic bag the dry ingredients (except egg powder)
- Mix in a bowl the vinegar, the lemon juice and 1833 of the water
- Mix the dry ingredients in the liquid and heat while stirring on a steam bath for 15 min.
- Cool to 20 °C
- Mix the egg powder with the remaining and add the mustard
- Create a vacuum in the Fryma of 500 mbar
- Turn on the scrapers and fill the Fryma with the starch mixture
- Add the egg/mustard mixture
- After 30 sec. add the oil (also in 30 sec.)
- Mix in the Fryma for another 30 sec.
- From this the dressing is obtained.

Tomato sauce

Ingredients

	%
Tomato puree	15,0
Starch derivative	4,0
Salt	2,5
Powdered sugar	12,5
Vinegar (5 %)	12,5
Sodium benzoate	0,1
Potassium sorbate	0,1
Tap water	53,3
Total	100,0

Preparation procedure

- Mix the dry ingredients
- Mix, water and the tomato puree in a sauce pan
- Add the dry ingredient mix to the liquid
- Heat while stirring to 90-95 °C
- Heat for 15 min at this temperature
- Cool to 20 °C

Tomato soup

Ingredients

	g	%
Tap water	345,0	86,25
Tomato puree	28,0	7,00
Starch derivative	16,0	4,00
Sugar	4,0	1,00
Salt	3,0	0,75
Sun flower oil	1,6	0,40
Tomato taste 2M-18322	1,2	0,30
Bouillon taste 34099	0,8	0,20
MSG	0,4	0,10
Total	400,0	100,00

Preparation procedure

- The ingredients, except the starch derivative, are mixed in
  beaker
- The mixture is heated to 45-50 °C while stirring
- The solution is cooled to 25-30 °C
- 16,0 g of starch derivative is weighed into a can
- The can is filled with the solution to a total of 400 g
- The can is closed and shaken
- The is sterilized for 55 min at 120 °C

UHT pudding (Dutch style)

Ingredients

			%
Skimmed milk powder	3150	g	9,3
Sugar	2310	g	6,8
Starch derivative	1380	g	4,1
Colour/taste	39	g	0,12
Salt	15	g	0,04
Satiagel HMR	7,5g		0,02
Tap water	27	L	79,6

preparation procedure

In a vessel 27 L water is given. To this the milk powder is added and suspended by stirring. The rest of the ingredients is mixed and after 5 min added to the milk. The suspension is pumped to a buffer tank and heated through a plate-exchanger to 80 °C and transferred to a jet cooker and cooked at 140 °C for a few seconds. The pudding is cooled to 40 °C and filled into cups that are subsequently sealed.

Gel strength measurement

The gel strength of the dressing is measured on a Stevens LFRA apparatus using a TA 11 plunger with a speed of 2 mm/s and a penetration depth of 40 mm.

A spoonable dressing was prepared according to procedure A. The gel strength of the products was determined. The results are summarised in table 5. Also the products were evaluated for their sensoric properties.

Table 5. Stevens gel strength (in mPas) of a spoonable dressing prepared according to procedure A

Product	starch	gel strength after 1 day	gel strength after 1 week	gel strength after 1 month	gel strength after 6 months
A	APS	81	82	98	150
B	WMS	71	76	92	159
C**	PS	25	25	-	-

** Product low viscous, phase separation after 1 week

The dressings of based on the products A and B were both shiny directly after preparation. After 6 months, however, they were slightly gelled and somewhat dull. This could be reversed with stirring by hand. The dressing based on product C was low viscous and had a pulpy, dull texture. After two weeks phase separation in the dressing of product C was observed.

In the before mentioned dressing the pH of the system is about 4,3. The pH can have large influence on the properties of products depending on the modification and the type of starch. In table 6 the results are summarised for a more acidic type of dressing.

Table 6 Stevens gel strength (in mPas) of dressings prepared according to procedure B

Product	starch	gel strength after 1 week	gel strength after 1 month	gel strength after 2 months	gel strength after 6 months
D	APS	150	170	180	250
E	WMS	140	170	190	250

The dressings were both shiny directly after preparation. After 6 months, however, they were slightly gelled and somewhat dull. This could be reversed with stirring by hand.

As a third possibility amylopectin potato starches can be applied in tomato sauce. The results have been summarised in table 7.

Table 7 Gel strength and viscosity of tomato sauce

Product	starch	Modifi-cation	Stevens	Brookfield HAT	Brookfield RVT
F	WMS	Adip-ac	60	11600	17000
G	APS	NaTMF-ac	75	14200	16000
H	APS	Adip-ac	72	13400	14800

The tomato sauces based on all product were shiny and short. Potato starch derivatives give pulpy textures which are sometimes prefered.

Table 8 Viscosity of tomato soups

Product	starch	Modifi-cation	Viscosity in mPas after....		
			1 month	3 months	6 months
F	WMS	Adip-ac	8080	5180	6300
E	WMS	$POCl_3$-HP	9340	7860	8280
I	APS	Adip-ac	8540	7140	5900
J	APS	NaTMF-HP	9440	9480	10400

The conclusion from the experiments is that the viscosity of the soups based on APS and WMS is comparable. The texture of all soups is short and shiny.

The conclusion from the food examples is that due to graular disintegration amylopectin potato starch

derivatives give short, shiny textures comparable to non disintegrated waxy cereal derivatives. (Waxy) cereal starches have the draw back that they have a less desirable taste and that they sometimes cannot be applied in some food systems due to religious restrictions.

Table 9
Processing equipment and conditions affecting starch performance

Equipment	Conditions
Steam jacketed kettle	Low shear, long cook and cooling times
Swept surface cooker and cooler	Medium shear, fast cooking and cooling times
Steam infusion cooker	Medium shear, high temperature, short cooking time
Pumping equipment	Medium to high shear
Steam injection (jet) cooker	Medium/high shear, fast cook, high temperature
Swept surface cooker with flash cooling	High shear, fast cook and cooling times
Plate heat exchange cooker and cooler	High shear, short cooking and cooling times
Colloid mill	Very high shear

Note: Steam jacketed kettles with sweeping mixers are normally considered as low in shear; steam injection and plate cookers as medium in shear; plate coolers, flash coolers and milling equipment as high, and homogenisers as extremely high in shear. This is a general statement, damage of course also depends on the length of treatment and on the temperatures used. It is for example possible that a steam jacketed kettle may do as much damage to the starch granule over an extended time as an homogeniser in a short time.

Figure legends

Figure 1
Amylopectine PS with low cross-link level before shear.

Figure 2
Amylopectine PS with low cross-link level after 1 min. shear.

Figure 3
Amylopectine PS with low cross-link level after 2 min. shear.

Figure 4
Amylopectine PS with high cross-link level before shear.

Figure 5
Amylopectine PS with high cross-link level after 1 min. shear.

Figure 6
Amylopectine PS with high cross-link level after 2 min. shear.

Figure 7
Normal PS with low cross-link level before shear.

Figure 8
Normal PS with low cross-link level after 1 min. shear.

Figure 9
Normal PS with low cross-link level after 2 min. shear.

Figure 10
Normal PS with high cross-link level before shear.

Figure 11
Normal PS with high cross-link level after 2 min. shear.

Figure 12
Waxy maize starch with low cross-link level before shear.

Figure 13
Waxy maize starch with low cross-link level after 1 min. shear.

Figure 14
Waxy maize starch with low cross-link level after 2 min. shear.

Figure 15
Waxy maize starch with high cross-link level before shear.

Figure 16
Waxy maize starch with high cross-link level after 2 min. shear.

Figure 17
Degraded potato starch with high crosslink level before shear.

Figure 18
Degraded potato starch with high crosslink level after 2 min. shear.

Figure 19
The number average particle size distribution of starch in a retorted dessert. Line A is the distribution of an amylopectin PS derivative, line B the distribution of a normal PS derivative. The use of the amylopectin PS derivative results in a dessert with a smooth and shiny texture which is greatly appreciated by customers. Use of normal PS results in a coarse, blind or dull dessert

which is generally not well liked. Particle size was measured using microscopical optometric analyses; i.e. two lines were drawn at random through a microscopic picture of a dessert sample, comparable to as shown for example in anyone of figures 1 to 16, and each particle dissected by said line was assigned a size corresponding with the length of the line segment cutting through said particle.

CLAIMS

1. A method for providing a foodstuff with a short or smooth texture and/or shiny appearance after heat and/or shear treatment comprising adding to the ingredients of said foodstuff a cross-linked starch selected for its capacity to disintegrate into discrete particles after processing.

2. A method according to claim 1 wherein said cross-linked starch is non-cereal starch.

3. A method according to claim 1 or 2 wherein said starch is degraded.

4. A method according to anyone of claims 1 to 3 wherein said starch has an amylopectin:amylose ratio of at least 90:10, preferably at least 95:5, more preferably at least 99:1.

5. A composition comprising a cross-linked starch for use in a method according to anyone of claims 1 to 4.

6. A composition according to claim 5 wherein said starch is non-cereal starch.

7. A composition according to claim 5 or 6 wherein said starch has an amylopectine:amylose ratio of at least 90:10, preferably at least 95:5, more preferably at least 99:1.

8. A composition according to anyone of claims 5 to 7 wherein said starch is derived from a genetically modified potato plant mutant or from an amylose-free potato plant mutant.

9. A composition according to anyone of claims 5 to 8 wherein said starch has been subjected to stabilisation.

10. Use of a cross-linked starch in the preparation of a foodstuff wherein the starch granules disintegrate into discrete particles.

11. A foodstuff obtainable by using a method according to anyone of claims 1 to 4.

12. A foodstuff comprising discrete particles derived from a starch granule.

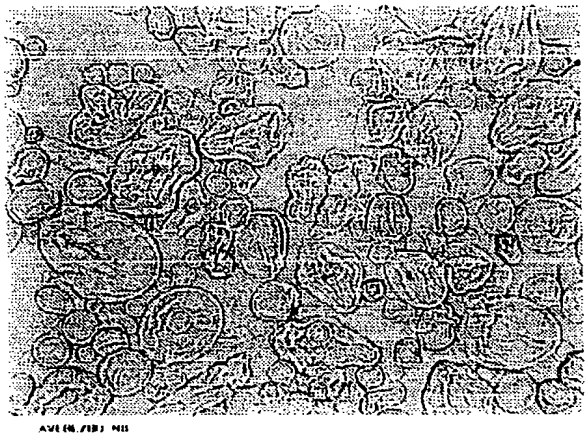

Figure 1 - Amylopectin PS with low crosslink level before shear

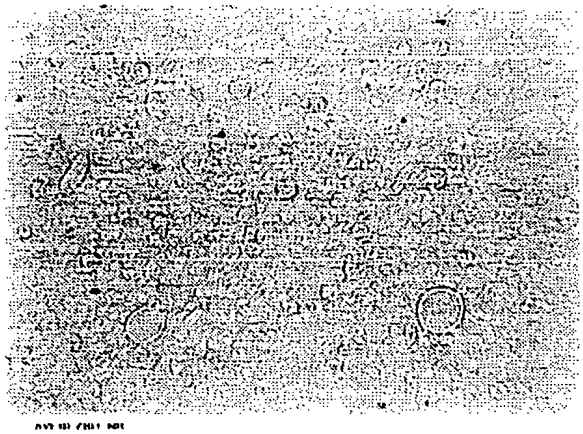

Figure 2 - Amylopectin PS with low crosslink level after 1 min. shear

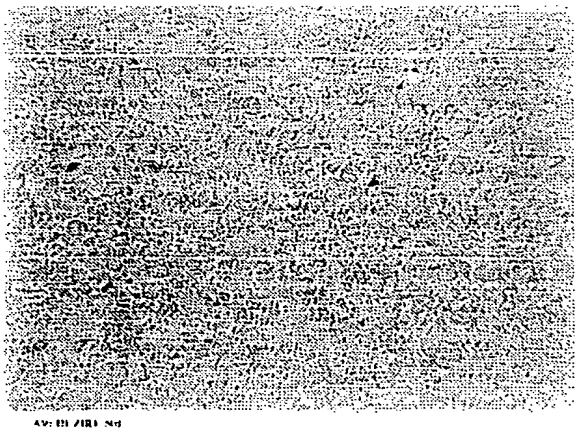

Figure 3 - Amylopectin PS with low crosslink level after 2 min. shear

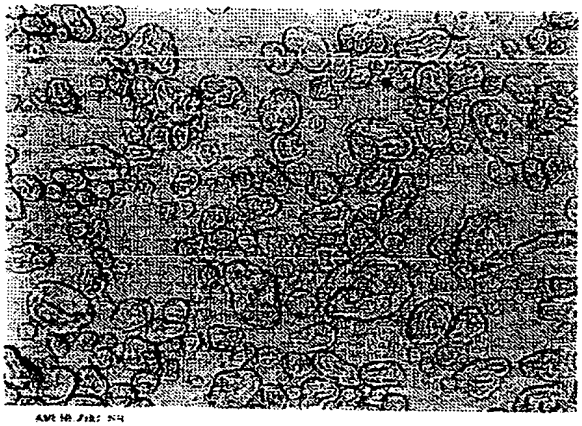

Figure 4 - Amylopectin PS with high crosslink level before shear

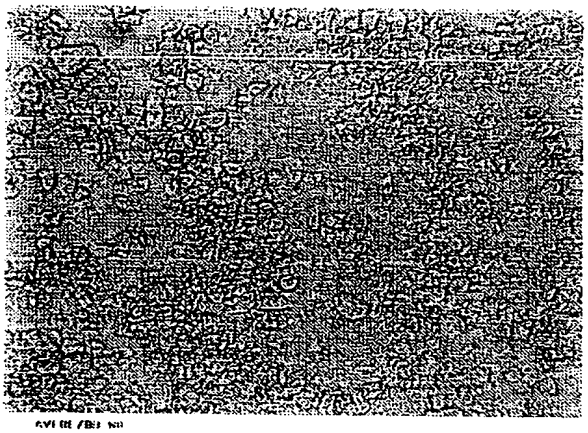

Figure 5 - Amylopectin PS with high crosslink level after 1 min. shear

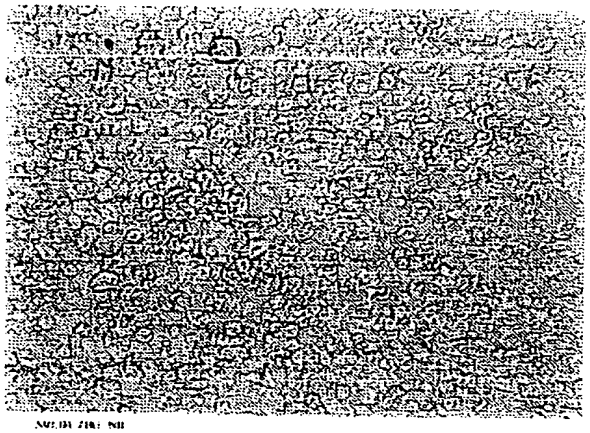

Figure 6 - Amylopectin PS with high crosslink level after 2 min. shear

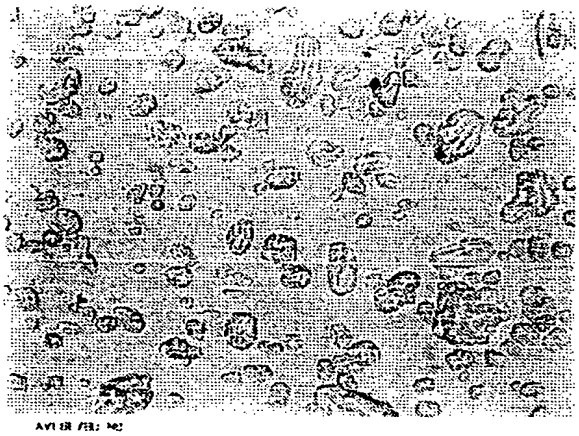

Figure 7 - Normal PS with low crosslink level before shear

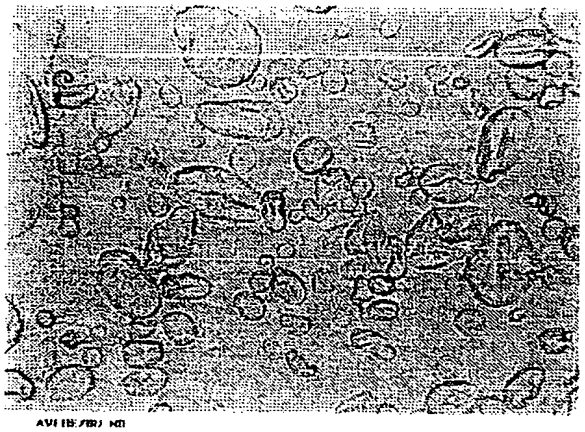

Figure 8 - Normal PS with low crosslink level after 1 min. shear

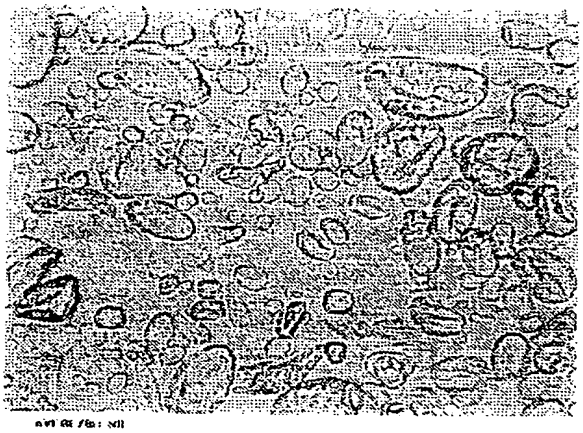

Figure 9 - Normal PS with low crosslink level after 2 min. shear

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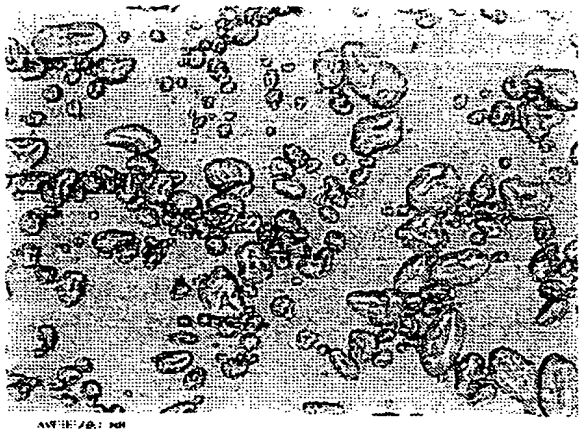

Figure 10 - Normal PS with high crosslink level before shear

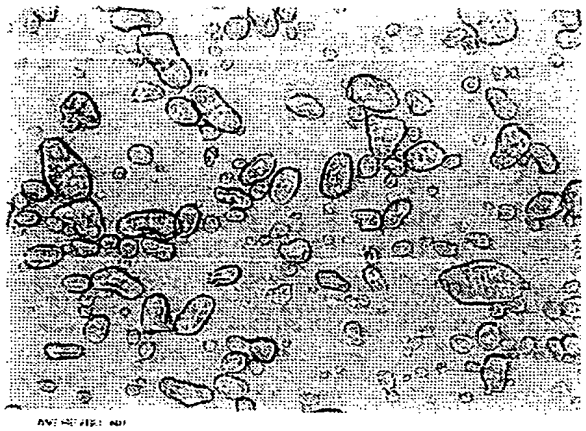

Figure 11 - Normal PS with high crosslink level after 2 min. shear

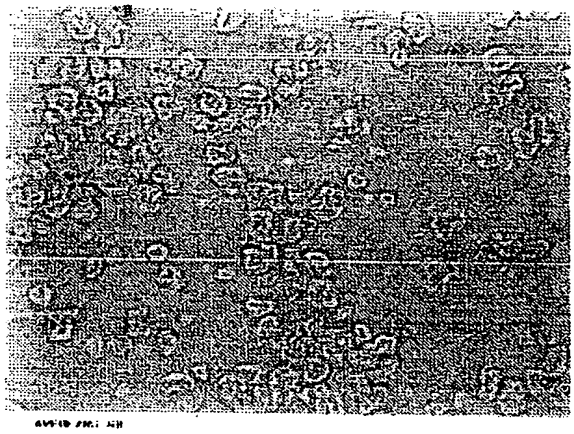

Figure 12 - Waxy maize starch with low crosslink level before shear

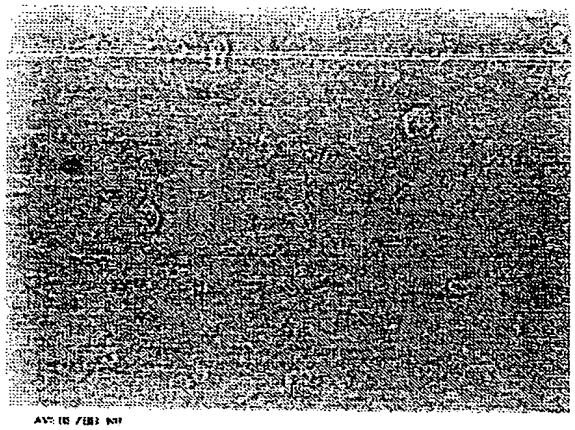

Figure 13 - Waxy maize starch with low crosslink level after 1 min. shear

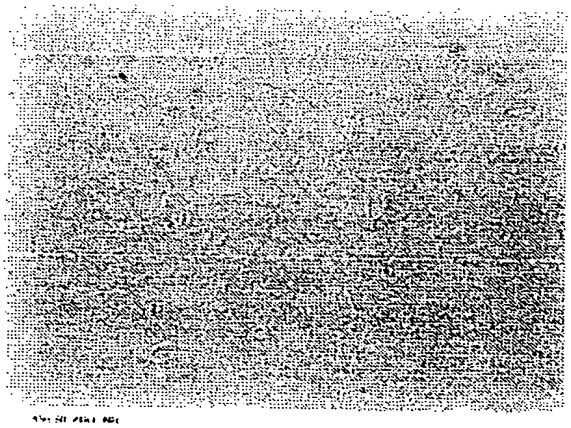

Figure 14 - Waxy maize starch with low crosslink level after 2 min. shear

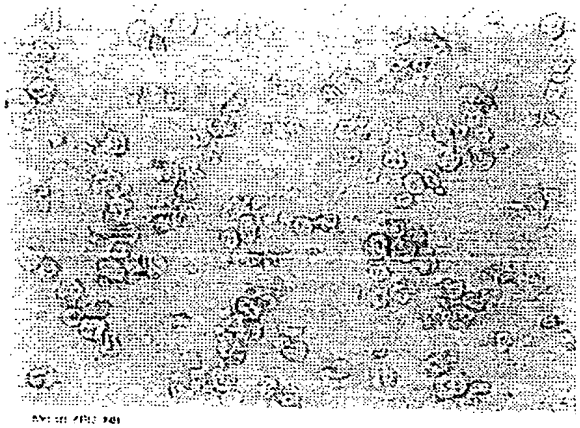

Figure 15 - Waxy maize starch with high crosslink level before shear

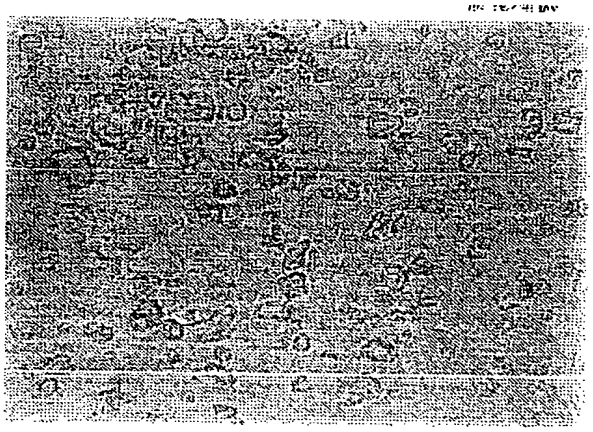

Figure 16 - Waxy maize starch with high crosslink level after 2 min. shear

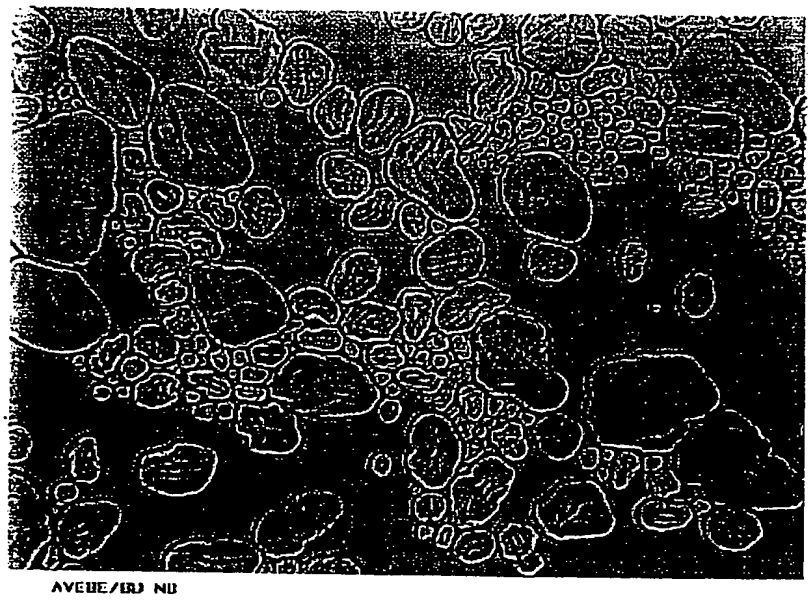

Figure 17
Degraded potato starch with high crosslink level before shear.

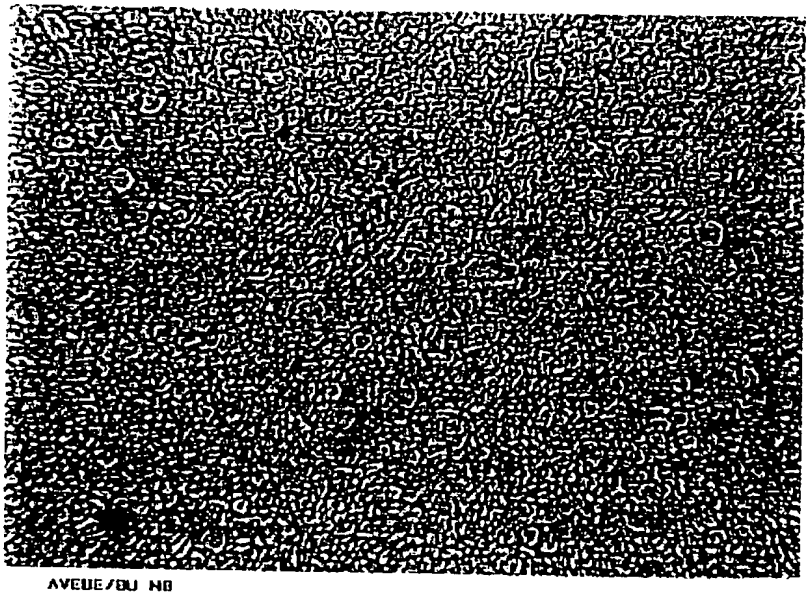

Figure 18
Degraded potato starch with high crosslink level after 2 min. shear.

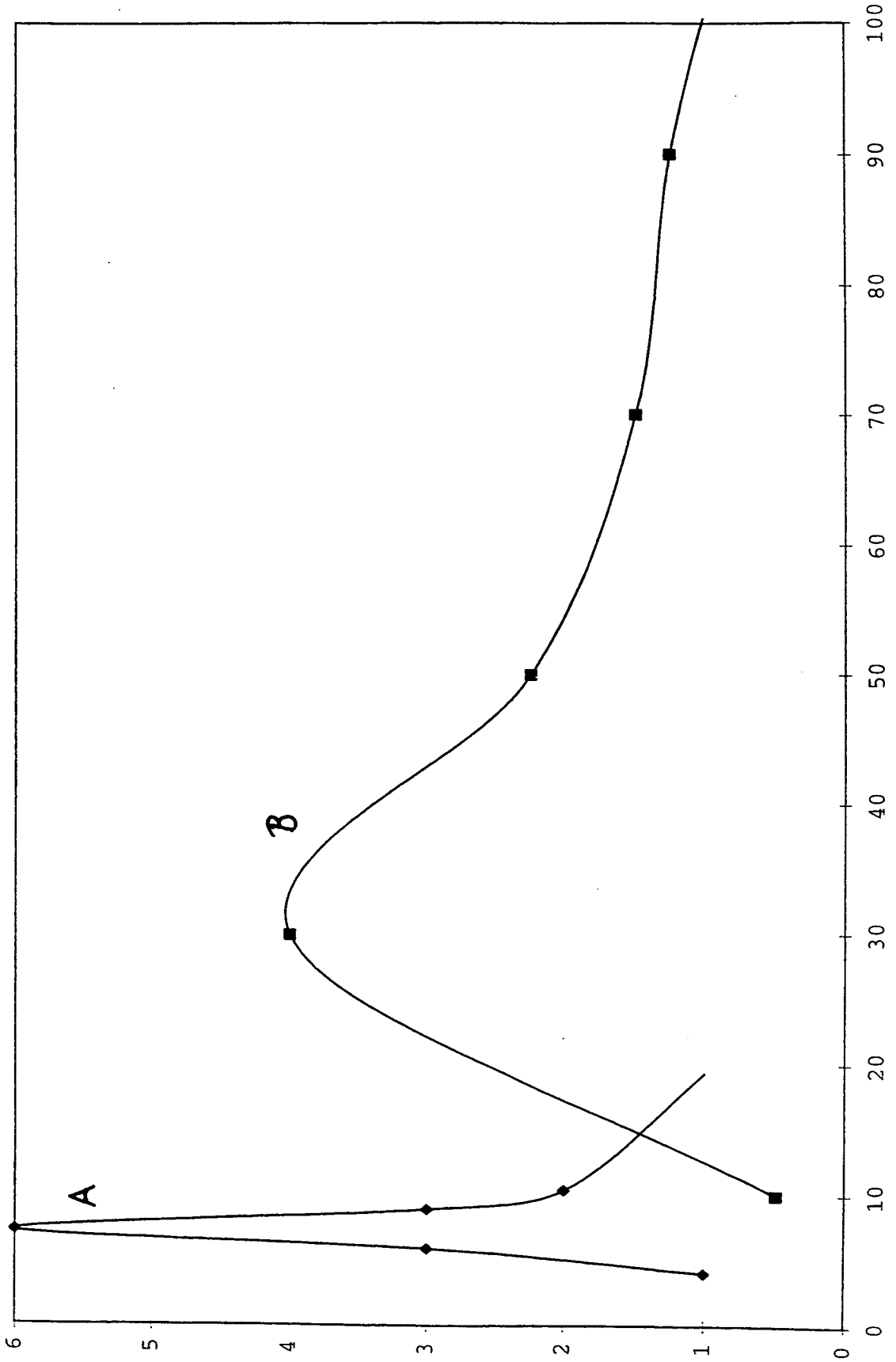

Figure 19

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
P22179PC00		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/NL 00/ 00174	16/03/2000	17/03/1999

Applicant

COÖPERATIEVE VERKOOP-EN PRODUCTIEVERENIGING VAN...

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [X] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established by this Authority to read as follows:

   FOODSTUFF CONTAINING DISCRETE STARCH PARTICLES

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. _____

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [X] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 00/00174

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A23L1/0522

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 89 12403 A (NUTRASWEET CO) 28 December 1989 (1989-12-28) cited in the application page 3, line 9 -page 4, line 31; example 1	1-12
X	US 5 370 894 A (SINGER NORMAN S) 6 December 1994 (1994-12-06) cited in the application column 1, line 15 - line 36	1-12
A	WO 98 31240 A (NESTLE SA ;KING SOLIS LUIS ROBERTO (EC); MOFFITT KENNETH RICHARD () 23 July 1998 (1998-07-23) cited in the application page 1, line 3 -page 2, line 16	1-12

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 July 2000	03/08/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Bendl, E

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 00/00174

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 796 868 A (NAT STARCH CHEM INVEST) 24 September 1997 (1997-09-24) page 4, line 18-25	1-12
X	US 4 368 212 A (HECKMAN ERWIN) 11 January 1983 (1983-01-11) cited in the application column 2, line 28 - line 34	1-12
P,X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 03, 30 March 2000 (2000-03-30) & JP 11 332468 A (MATSUTANI CHEM IND LTD), 7 December 1999 (1999-12-07) abstract	1-12

3

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/NL 00/00174

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		WO 8912403 A	28-12-1989
		DD 288748 A	11-04-1991

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/NL 00/00174

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